



## Global Security

# Source Physics Experiments (SPE)

### Introduction

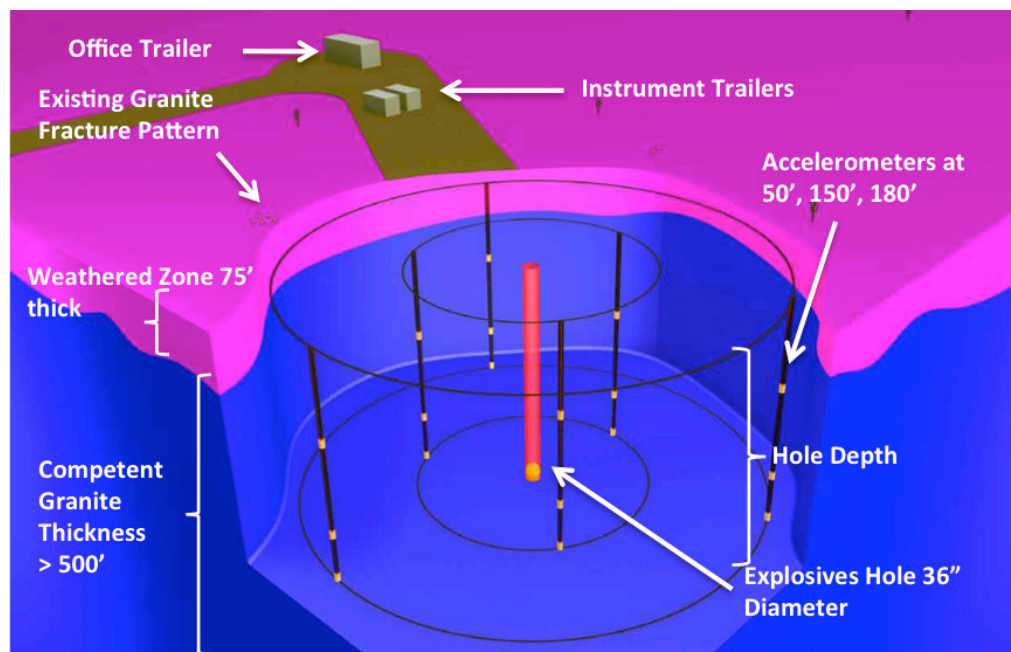
The U.S. Department of Energy, National Nuclear Security Administration is conducting a series of experiments aimed at improving arms control and nonproliferation treaty verification. The experiments will provide ground truth data that will enhance the United States' ability to detect and discriminate "low-yield" underground nuclear explosions from the clutter of conventional explosions and small earthquake signals. The experiments, called Source Physics Experiments (SPEs), are being conducted at the Nevada National Security Site (NNSS).

The SPEs are a series of underground chemical high-explosive (HE) detonations of various strengths at different depths designed to accomplish the following:

- Enhance the nation's monitoring and verification capabilities.
- Develop an explosive source prediction capability in order to be able to:
  - Perform source discrimination.
  - Perform source-to-receiver (sensor) waveform modeling.
  - Improve yield estimation.

Phase I of SPE has been completed and included the following shots, summarized by the size of the HE detonation, the depth of the explosion, and the material in which the detonation takes place:

- **SPE 1:** 220 pounds (lb) HE; in granite.
  - Objective: Validation of experimental design and initial modeling data collection.
- **SPEs 2 and 3:** 2,220 lb HE; same hole and medium depth (149 feet); in granite.
  - Objective: Effects of source medium damage.
- **SPE 4:** 200 lb HE; same hole, deepest shot (286 feet); in granite.
  - Objective: Minimal damage and surface effects.
- **SPE 5:** 11,077 lb HE; same hole, medium depth (250 feet); in granite.
  - Objective: Comparison to legacy seismic data from nuclear tests at regional (NV, UT, AZ, CA) stations.





*The SPE-6 canister filled with 4900 lbs of chemical explosives being lowered down hole to a depth of 100 ft.*

- **SPE 6:** 4900 lb HE; same hole; shallow depths (100 feet); in granite.
- Objective: Comparison of normal-depth explosions with extensive rock damage to the deeply buried shots (e.g., SPEs 1-4) with minimal damage.

A similar series of explosions will be conducted in alluvium in 2017-2018 in order to provide a comparison of different source emplacement rock types. Phase II of SPE will be called the Dry Alluvium

Geology Experiments. The SPEs are an example of the expanded role the NNSS is playing in our nation's nuclear security strategy.

These experiments are conducted by the NNSS management and operations contractor, National Security Technologies, LLC, in partnership with Los Alamos National Laboratory, Lawrence Livermore National Laboratory, Sandia National Laboratories, and the University of Nevada at Reno.



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